# The elusive planktonic freshwater chrysophyte *Bitrichia longispina*: a first record for Scottish lochs and comparison with the commoner species, *Bitrichia chodatii*

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Chrysophyte or golden algae are greatly under-recorded in the UK, despite their widespread dominance across nutrient-poor lakes in Northern Europe (Ptacnik *et al.*, 2008). They are particularly good indicators of oligotrophic waters as, unusually for algae, chrysophytes can supplement their nutrient supply through consumption of bacteria. It is unclear whether the apparent scarcity of chrysophyte algae is due to limited taxonomic understanding of this group or because the UK lake environment is different (e.g. prevailing Atlantic climate or impacted waters) and consequently confines their distribution.

The only known previous UK record of the planktonic chrysophyte *Bitrichia longispina* (J.W.G. Lund) Bourrelly, is from Wise E'en Tarn in Cumbria the English Lake District by the renowned phycologist Dr J.W.G. Lund, more than 60 years ago (Lund, 1949). Until now, there have been no subsequent documented records of this chrysophyte in the UK since the original finding (Kristiansen, 2002).

*Bitrichia longispina* therefore appears to be somewhat a rather elusive chrysophyte compared to its closely related species, *Bitrichia chodatii* (Reverdin) Chodat, which exhibits a widespread distribution pattern in Scottish freshwater lochs.

The Scottish Environment Protection Agency (SEPA) monitors the water quality of freshwater lochs as part of its obligation under the EU Water Framework Directive (European Commission, 2000). Freshwater phytoplankton communities are important indicators of the biointegrity of standing waters and are therefore used by SEPA to assess the ecological status of around 80 lochs in Scotland. Loch samples are collected at least three times a year for phytoplankton during the summer months, from July to September. Sub-samples of phytoplankton (preserved in Lugol's iodine) are examined using an inverted microscope and analysed according to standard procedures with counts of approximately 400 individuals (Brierley *et al.*, 2007; CEN, 2004 & 2008).

Small numbers (e.g. 5-10 cells per 100 ml sub-sample) of *Bitrichia longispina* were found in phytoplankton samples collected from Loch Langavat during the summer months of 2009. Loch Langavat (Scottish Gaelic: Langabhat) occupies an area of 1.43 $km^2$ aeross the Isle of Harris in the Outer Hebrides of Scotland (NGR: NG 046 897). It is relatively shallow (c. 5 m) and oligo-mesotrophic (annual mean total phosphorus (TP) concentration ranged from 7 to 13.6 µg $L^{-1}$, over 2007-09) in character. Recent palaeolimnological evidence using fossil diatoms has shown that the loch is slightly impacted by nutrient enrichment and no longer considered to be of pristine reference condition (Bennion *et al.*, 2004). Currently, this is the only monitored Scottish loch in which *Bitrichia longispina* is known to occur. However, work will continue to determine whether any other lochs in Scotland support this rather elusive chrysophyte. In contrast, the related species *Bitrichia chodatii* is commonly found in many Scottish lochs.

*Bitrichia longispina* has been mostly documented from water bodies in the Czech Republic (Juris, 1967; Kitner & Poulíčková, 2003), though further records may exist in the WISER phytoplankton database. Although generally rare, there are some reports of the chrysophyte from other European waters (Bourrelly, 1957; Starmach, 1985), and even Alaska (Hilliard, 1966). Together, these findings suggest that *B. longispina* preferentially occurs in relatively low nutrient waters. Accounts of *Bitrichia chodatii* are often from oligotrophic habitats (e.g. Hilliard, 1966; Brettum & Halvorsen, 2004), though the species is known also to occur in waters of varying quality and colouration (e.g. Juris, 1967; Lepistö *et al.*, 2004). This appears to fit in with the apparent widespread distribution of *B. chodatii*, though its prevalence in relation to environmental factors remains to be explored in Scottish lochs.

For some flagellated algae like chrysophytes, the structure of a cell's protective casing or 'lorica' is often used to differentiate between taxa, and this tactic usually applies to members of the *Bitrichia* genus (Menezes & Huszar, 1997). However, the loricae belonging to *Bitrichia chodatii* and *B. longispina* can appear similarly ovoid, leading to possible misidentification. In this case, spine morphology is a more useful taxonomic characteristic for distinguishing these two species from each other. The key diagnostic feature of *Bitrichia longispina* (Figs 1a, 1b) is that it possesses long and straight terminal spines, between 53-65 µm, and of relatively equal length (Lund, 1949; Juris, 1967; Kristiansen, 2002). The variability in spine length may be evidence of a functional response to the environment (e.g. trait conveying resistance to sinking or grazing) and is worthy of future research. By comparison, *Bitrichia chodatii* (Figs 2a, 2b) has shorter, usually <40 µm, and curved terminal spines of unequal length (Lund, 1949; Juris, 1967; Kristiansen, 2002).

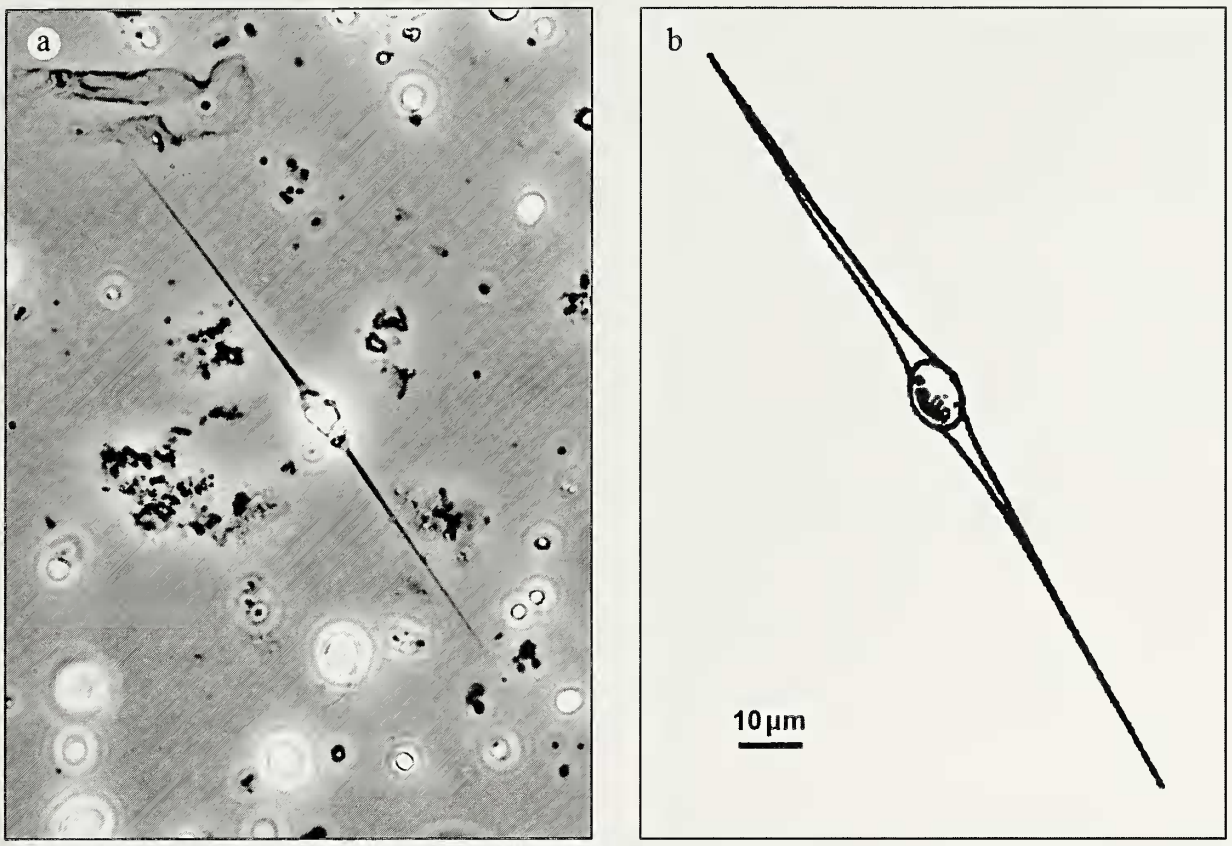


**Fig. 1.** (a) Photo-micrograph of *Bitrichia longispina,* (b) Illustration of *Bitrichia longispina* (x630 magnification) in Lugol's preserved sample.

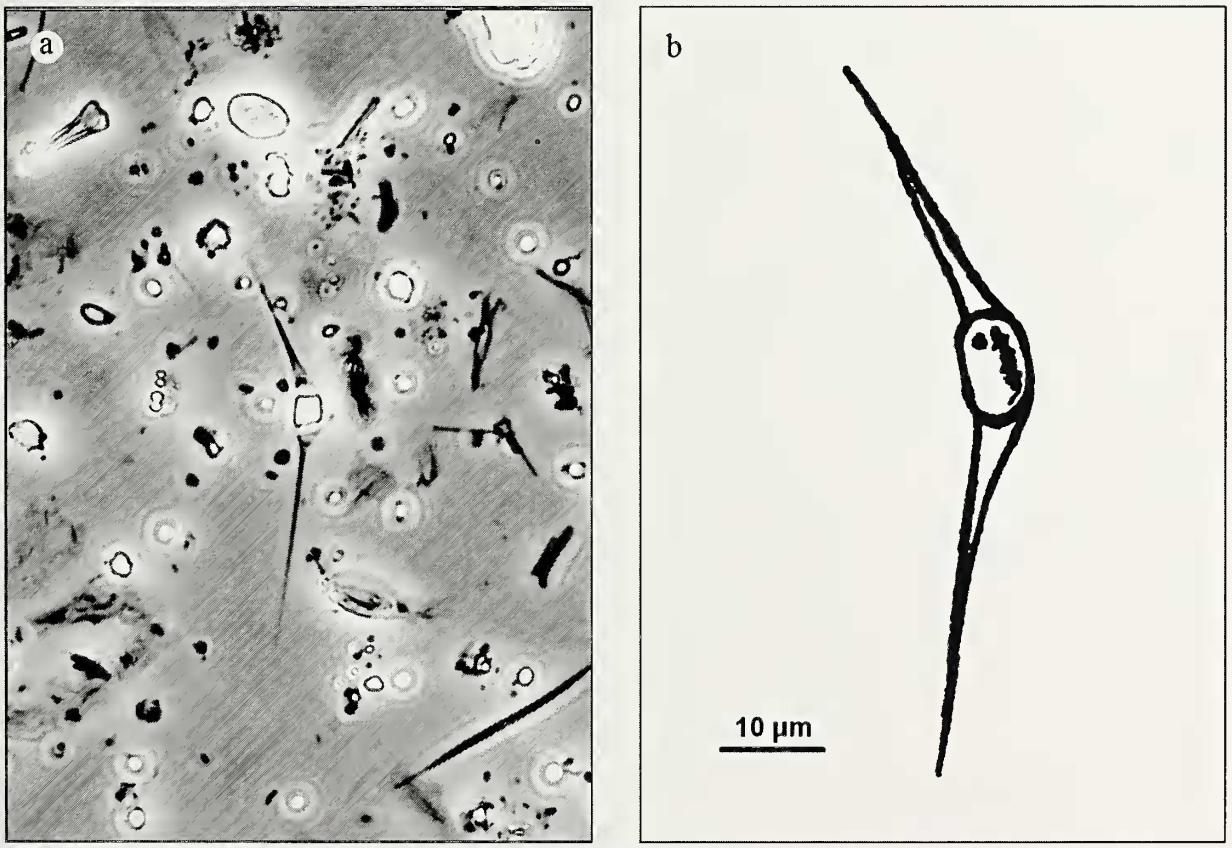


**Fig. 2.** (a) Photomicrograph of *Bitrichia chodatii*, (b) Illustration of *Bitrichia chodatii* (x630 magnifation) in Lugol's preserved sample.

More in-depth research would improve our knowledge of the seemingly different ecology of the two *Bitrichia* species. Such information would not only help resolve the limited distribution of *B. longispina*, but could also contribute to a better understanding of planktonic bioindicator species. This could improve European environment agencies' interpretations of the water quality status of our precious freshwater lake ecosystems.

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